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SELF-PREPARATION STANNOUS FLUORIDE PROPHYLACTIC TECHNIQUE IN PREVENTIVE DENTISTRY: REPORT AFTER TWO YEARS

by

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Bureau of Medicine and Surgery, Navy Department
Research Work Unit MR005.19-6027.02

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SUBMARINE MEDICAL RESEARCH LABORATORY
NAVAL SUBMARINE MEDICAL CENTER REPORT NO. 577

Bureau of Medicine and Surgery, Navy Department
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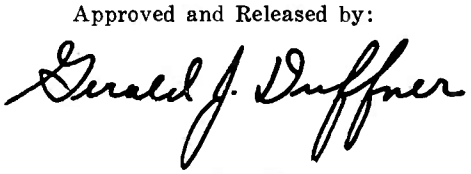

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SUMMARY PAGE

PROBLEM

To evaluate the effectiveness of the self-preparation technique as part of the three-agent SnF_2 treatment in preventive dentistry.

FINDINGS

After two years the self-preparation technique as the prophylactic phase of the three-agent SnF_2 treatment was found to be as effective as the operator-applied technique as a caries preventative.

APPLICATIONS

Encouraged by the findings of this and earlier studies, the U. S. Navy Dental Corps is already embarked in bringing this preventive dentistry treatment to all U. S. Navy and Marine Corps personnel.

ADMINSTRATIVE INFORMATION

This investigation was conducted as a part of Bureau of Medicine and Surgery Research Work Unit MR005.19-6027 — Self Applied Stannous Fluoride Prophylactic Technique in Preventive Dentistry. This report has been designated as Submarine Medical Research Laboratory Report No. 577. It is Report No. 3 on this Work Unit, and was approved for publication as of 18 April 1969.

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ABSTRACT

The topical application of stannous fluoride to the teeth of military personnel has been shown to significantly reduce the dental decay rates of the men so treated. The time spent by the dentist in polishing the teeth for this treatment is so great, however, that these applications could not be given to all Naval personnel. A method whereby the individual polishes his own teeth under supervision has been evaluated and the results after two years indicate significant decay reductions comparable to that seen in men who received the entire treatment from the dentist. The new self-preparation method should enable every man in the Naval service to receive the benefits of topical stannous fluoride treatment.

SELF-PREPARATION STANNOUS FLUORIDE PROPHYLACTIC TECHNIQUE IN PREVENTIVE DENTISTRY: REPORT AFTER TWO YEARS

INTRODUCTION

The results of a previous study[1,2,3] established the effectiveness of stannous fluoride, topically applied as a cariostatic agent in young adults. The incidence of caries was reduced upwards of 70% by a procedure which consisted of an annual prophylaxis with a stannous fluoride — special pumice mixture, and a topical application of aqueous stannous fluoride, followed by the daily use of a dentifrice containing stannous fluoride. In the Navy's preventive dentistry program, this procedure is called the three-agent stannous fluoride treatment. That study reinforced the findings of other investigators[4,5,6] that stannous fluoride, so employed, is an effective cariostatic agent for young adults.

While this breakthrough provided us with an effective tool for reducing the incidence of caries, its application required as much professional time as is required to correct the condition we were trying to prevent; therefore, it would not be possible to render this treatment without substantially reducing the other facets of total dental treatment to which the Navy Dental Corps is committed for the combined Navy-Marine personnel. The time consuming aspect of the three-agent stannous fluoride treatment lies in the prophylaxis phase — accomplished on a one to one basis —(one patient - one operator) requiring upwards of 30 minutes for completion. If a way could be devised to prepare the teeth effectively for the aqueous topical application and thereby reduce the prophylaxis time expended without impairing the cariostatic effectiveness of the three-agent stannous fluoride treatment, we could prevent a lesion in less time than it takes to restore one. The 1951 report of Chrietzberg[7] pointed the way. Children who brushed twice daily for two weeks under supervision, before topical fluoride application, had as great a reduction in caries incidence as though a conventional prophylaxis had been given prior to topical application. In a feasibility study, Foster[8] found that properly oriented patients could and did accomplish the tooth polishing or prophylaxis phase upon themselves using an ordinary toothbrush and the special pumice paste containing stannous fluoride as well as did the average dental technician using a rotary instrument and a rubber cup. Thus, in a little more than ten minutes, a large group of men under the guidance and supervision of one dental technician could prepare their teeth surfaces for the reception of the liquid topical fluoride application in the same elapsed time as the one patient—one operator prophylaxis technique employed in the earlier study.[2,3] The purpose then, of this study, is to evaluate the cariostasis potential of the self-preparation prophylaxis technique as compared with the operator-prophylaxis technique: each to be tested as part of the Navy's three-agent stannous flouride treatment method in preventive dentistry.

MATERIALS AND METHODS

Subjects selected for this study were U.S. Navy enlisted men, 18 to 22 years of age, who had evidence of active caries lesions and who had no previous exposure to topical SnF_2 applications. They were examined clinically and with a series of five bite-wing roentgenograms, initially and at six month intervals, by a single examiner. The subjects were randomly distributed into five groups: Two comprising the operator-applied technique as reported previously[1,2,3] and three groups comprising the self-prepared technique. The treatment schedule, initially and at 12 months, consisted of: (1) The prophylaxis phase—the application of 8.9% SnF_2 in a compatible lava pumice paste either by the operator or by the "self-prepared" method; (2) the topical phase — the application of 10% SnF_2 aqueous solution to the dried tooth surface for a minimum of 15 seconds; and (3) the home care phase — the provision for

the daily use of a dentifrice containing 0.4% SnF_2. In an attempt to maintain uniform procedures, those subjects denied SnF_2 treatments were provided identical treatment procedures with appropriate placebo preparations containing sodium chloride as a substitute for stannous fluoride in the prophylaxis paste and in the topical solution. Since the experimental and control dentifrices were identical except for the presence or absence of the stannous fluoride, and since they were indistinguishable by appearance and taste, sodium chloride was not added to the control dentifrice.

EXPERIMENTAL DESIGN

The experimental design is shown in Table I.

TABLE I
EXPERIMENTAL DESIGN

Group	1st Stage	2nd Stage	3rd Stege
A*	Prophy paste + 8.9% SnF_2	10% aqueous SnF_2 topical	Dentifrice + .4% SnF_2
B*	Prophy paste + NaCl	Aqueous NaCl topicel	Dentifrice - SnF_2
C**	Prophy peste + 8.9% SnF_2	10% equeous*** SnF_2 topical	Dentifrice + .4% SnF_2
D**	Prophy paste + NaCl	Aqueous NaCl topical	Dentifrice - SnF_2
E**	Prophy paste + 8.9% SnF_2	10% aqueous SnF_2 topical	Dentifrice + .4% SnF_2

*Group A and B - 1st stage is operator-applied.

**Group C, D and E - 1st stage is self-prepared.

***Aqueous topical taped interproximally with unwaxed floss.

Group A received the total SnF_2 treatment: 8.9% SnF_2 in a compatible lava pumice prophylaxis paste, operator-applied; a 15 second 10% aqueous SnF_2 topical application, and a dentifrice for home use containing 0.4% SnF_2. Group B received the same treatment routine except for the absence of SnF_2 in all three phases of treatment. Group C received the same treatment schedule as Group A, except that the prophylaxis phase was self-applied. Group D received the same treatment as Group C, except for the absence of SnF_2 in all three phases of treatment. Group E received the same treatment as did Group C except that there was no taping of the interproximal surfaces with unwaxed floss. The technique for applying the prophylaxis paste (operator-applied) and the aqueous topical applications have previously been described by Dudding and Muhler.[9] The self-preparation technique as employed in this study is as follows:

> "The prophylactic paste is placed on the toothbrush and the buccal or facial surfaces of one quadrant are brushed with an occlusal ward stroke for one minute, care being exercised to keep away from the gingiva. This is continued for one minute from the most posterior tooth to the midline. More paste is picked up and the lingual surfaces of the same quadrant are brushed in the same fashion for one minute. Again, more paste is picked up and the occlusal surfaces are brushed for one-half minute with a back and for ward stroke. The subject may then rinse, ballooning out the cheeks to prevent the trapping of the paste. The process is repeated for the other quadrants; two and a half minutes for each quadrant, 10 minutes of brushing time in all."

No attempt was made to change the oral hygiene habits of the subject. He received no special home care instructions. He was merely asked to use the coded dentifrice continuously supplied him with the same frequency and application method he had employed with his former dentifrice. He was also continuously supplied with three-row, medium, nylon-bristled toothbrushes.

RESULTS AND DISCUSSION

Due to the personnel operational needs of the Navy, the total number of subjects available for recall and re-examination decreased as the study progressed. Nevertheless, there was an adequate group balance during the study with regard to initial age, DMF surfaces, and DMF teeth for those subjects who completed the two-year study. The group balance of those who completed 12 months of the study has previously been reported[10]. The initial examination established a bench

TABLE II
INITIAL AGE FOR SUBJECTS WHO COMPLETED TWO-YEAR STUDY

Group	N	Age (mean)	Critical Ratio
A	58	20.72 ± 0.142*	1.45
B	62	20.60 ± 0.562	0.56
C	91	20.43 ± 0.631	0.63
D	88	20.40 ± 0.863	0.86
E	82	20.52 ± 0.045	0.05
Population	381	20.51	

*Standard error of the mean.

TABLE III
INITIAL DMFS BALANCE FOR SUBJECTS WHO COMPLETED TWO-YEAR STUDY

Group	N	DMFS (mean)	Critical Ratio
A	58	37.21 ± 2.677*	0.22
B	62	33.52 ± 2.172	1.43
C	91	33.25 ± 2.004	1.68
D	88	39.68 ± 2.080	1.47
E	82	38.99 ± 2.404	0.99
Population	381	36.62	

*Standard error of the mean.

mark for the two-year study. The initial balance as to age, for those subjects who completed two years of study, are shown in Table II. The mean age ranged from 20.40 years to 20.72 years and were found to be randomly distributed when submitted to the critical ratio test. Tables III and IV show the initial DMFS and DMFT balances and random distribution of the same subjects who completed two years of study.

In essence, this study is in two parts: (1) A repeat of the earlier study,[2, 3] the operator-applied technique comprising Group A and its control, Group B; and (2) the self-prepared technique comprising Groups C and E with their control, Group D.

TABLE IV
INITIAL DMFT BALANCE FOR SUBJECTS WHO COMPLETED TWO-YEAR STUDY

Group	N	DMFT (mean)	Critical Ratio
A	58	14.53 ± 0.689*	0.19
B	62	14.10 ± 0.630	0.47
C	91	13.42 ± 0.568	1.72
D	88	15.06 ± 0.550	1.21
E	82	14.90 ± 0.645	0.78
Population	381	14.396	

*Standard error of the mean.

Table V shows the DMFS increments for those subjects who completed two years of study. Statistical analysis revealed lesser DMFS increments for each experimental group when compared with its respective control. In the groups where the prophylaxis paste was operator-applied the lesser increment of experimental Group A compared with its control, Group B, may be expressed as a 59% reduction in the caries attack rate. This difference is highly significant, $P<.001$. In the groups where the prophylaxis paste is self-applied, the lesser DMFS increments for experiemntal Groups C and E compared with their control, Group B, may be expressed as a 56.1% and a 51.7% reduction in the caries attack rate. These differences too are highly significant, $P<.001$. The increment of the experimental groups which range from 1.60 to 2.10 DMFS are less than half of the increments of the control groups which range from 3.90 to 4.35 DMFS. This difference is more graphically demonstrated in Figure 1.

Table VI shows the DMFT increments for the same groups as in the DMFS data. The lesser increments of the experimental groups compared with their respective control groups reflect significant reductions in the caries attack rate. These data may be analyzed in a different manner. Table VII details the percentage of subjects in each group who had no new DMFS after two years. These ranged from a low of 15% and 17% in the control groups, up to 26%, 33% and 34% in the experimental groups. Conversely, the percentage of subjects who had five or more new DMFS ranged from 12% in each of the ex-

TABLE V
DMFS INCREMENTS FOR SUBJECTS WHO COMPLETED TWO-YEAR STUDY

Group	N	DMFS (mean)	% Reduction	Chance Probability
A	58	1.60 ± 0.313*	59.0	P < .001
B	62	3.90 ± 0.521	-	-
C	91	1.91 ± 0.287	56.1	P < .001
D	88	4.35 ± 0.442	-	-
E	82	2.10 ± 0.266	51.7	P < .001

*Standard error of the mean.

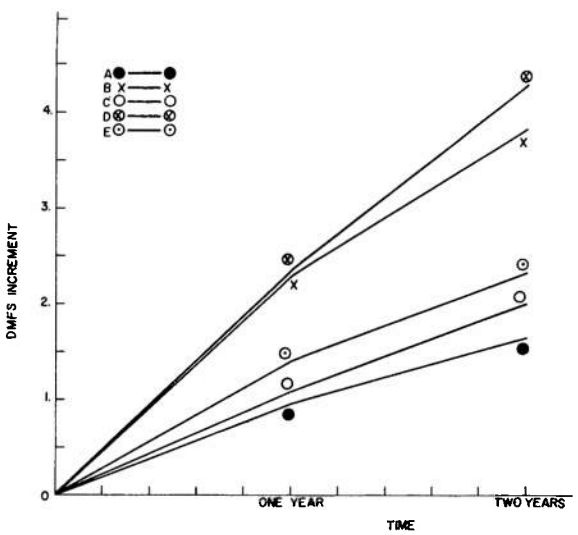

Figure 1—DMFS Increments for Subjects Examined After One and Two Years.

perimental groups, up to 31% and 35% in the control groups. The differences in these distributions were highly significant on the basis of the chi square test, (The chance probability was less than one in a thousand).

It is readily apparent from these data that the benefits of the self-applied technique are most dramatic when considering the DMFS index. This is undoubtedly because a higher incidence of disease in the control groups is derived by this assessment than the DMFT in this age group.

TABLE VI
DMFT INCREMENTS FOR SUBJECTS WHO COMPLETED TWO-YEAR STUDY

Group	N	DMFT (mean)	% Reduction	Chance Probability
A	58	0.21 ± 0.114*	79.6	P < .001
B	62	1.03 ± 0.164	-	-
C	91	0.32 ± 0.105	70.1	P < .001
D	88	1.07 ± 0.144	-	-
E	82	0.48 ± 0.107	55.1	P < .01

*Standard error of the mean.

These data are in keeping with the findings reported after one year[10] and reinforce the feasibility of substituting the self-prepared prophylaxis technique for the operator-applied prophylaxis technique in the three-agent stannous fluoride treatment in the United States Navy's Preventive Dentistry Program. Such a modification of technique will substantially reduce the costly man hours of treatment time. A further reduction in treatment time can be achieved by the elimination of the interproximal flossing.

TABLE VII
PERCENTAGE AND NUMBER OF SUBJECTS IN EACH GROUP WHO SHOWED VARIOUS DMFS INCREMENTS AFTER TWO-YEAR STUDY

Increment	A	B	C	D	E	Total
0*	34(20)**	15(9)	33(30)	17(15)	26(21)	95
1 - 2	38(22)	35(22)	33(30)	25(22)	30(25)	121
3 - 4	16(9)	19(12)	22(20)	23(20)	32(26)	87
5 and over	12(7)	31(19)	12(11)	35(31)	12(10)	78
Total	(58)	(62)	(91)	(88)	(82)	

Chi square total = 36.61 P < .001

*Includes diagnostic reversals

**Number of subjects

SUMMARY

The cariostatic effectiveness of the three-agent SnF_2 treatment method in preventive dentistry, utilizing a self-prepared prophylaxis technique, was studied in young adult male Naval personnel. After two years, statistical analysis of the data reveals:

1. Significant reductions in the DMFS and DMFT increments of the experimental groups over the control groups.

2. The interproximal flossing of the aqueous SnF_2 topical application can be eliminated at no significant decrease in effectiveness of the technique.

3. The self-prepared prophylaxis technique is as effective as the operator-applied prophylaxis technique in the three-agent SnF_2 treatment, and a substantial saving in the time could be realized by the substitution of the self-prepared prophylaxis phase for the operator-applied prophylaxis phase of the three-agent SnF_2 treatment method in the Navy's Preventive Dentistry Program.

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13. ABSTRACT

The topical application of stannous fluoride to the teeth of military personnel has been shown to significantly reduce the dental decay rates of the men so treated. The time spent by the dentist in polishing the teeth for this treatment is so great, however, that these applications could not be given to all Naval personnel. A method whereby the individual polishes his own teeth under supervision has been evaluated and the results after two years indicate significant decay reductions comparable to that seen in men who received the entire treatment from the dentist. The new self-preparation method should enable every man in the Naval service to receive the benefits of topical stannous fluoride treatment.

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